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Operating my Shack Remotely

How I use my home Shack remotely

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Scope and Why?

- The scope of this presentation is accessing your personal shack by yourself. Not a shared resource for use by a club etc….
- From within your home
  - Don’t need to be in your shack, operate from the sofa, garden, bedroom, bath?
- Whilst away from home
  - If you travel for work, nights in hotels, on holiday, “work”, mother in laws etc.
- Never need miss an opening or rare activation
- Warning…Not a cure for insomnia.

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Challenges to consider

How diverse is the range of equipment you want to access?

- Multiple brands of radio?
- Different antennas?
- Rotator?
- Different modes, CW, Data etc.., Power Amps?

Safety and licensing considerations

- Must be able to power it all down remotely
- Ideally disconnect antennas when not used
- Internet security if accessing remotely

- What platform do you want to use (PC, Mac, iPad…etc)

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Options Considered

- There are brand specific Remote control software packages
  - Icom RS-BA1, Yaesu SCU-LAN10, Elecraft K3/K4, Flex SmartLink etc..
- There are generic Remote Radio Control software packages
  - RemoteRig, HamRadioDeluxe, RCForb, WFView
- You could just remote access your home PC that has the radio attached
  - RDP, TeamViewer etc.. (there are many)

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My Preference/Choice

- Many packages provide great remote control for basic operation but have problems when wanting to use specific data modes remotely.
- I wanted a minimalist solution for convenience
- I opted for an iOS app (for iPhone and iPad) by Marcus DL8MRE.
  - Versions that support Icom, Kenwood, Yaesu, Flex ….
  - Extensive support including integrated logging, FT8, CW etc.
- Connect direct to Radio – no PC/Micro involved
- I Complimented that with other in-shack solutions for power etc.

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Networking – a quick course

- Whether at home or away you want to aim for:
  - Minimal packet loss, good ping times.
  - Poor connectivity can affect quality of audio and digital mode errors.
  - You don't actually need super fast connections, I have operated at very slow speeds of just a few Mbps, so long as its consistent and uninterrupted.

- If you're operating away from home
  - Need to allow connection through your firewall.
  - Outside of many peoples comfort zone. Ask a friend.
  - Risky if you're unsure !

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Networking – IP Addresses

- Your network connected devices, PC, Radio etc… will have a unique (to your home) IP address. You will need to know these.
- By default IP addresses are allocated by your router, and can change, so it is good to give them a fixed IP.
- It is safer to ‘reserve’ an IP for the important devices using the Router. This way the router prevents anything else being given the same IP, which would be bad.
- Once you have fixed the IP of the device, make a note for use in the remote software etc.

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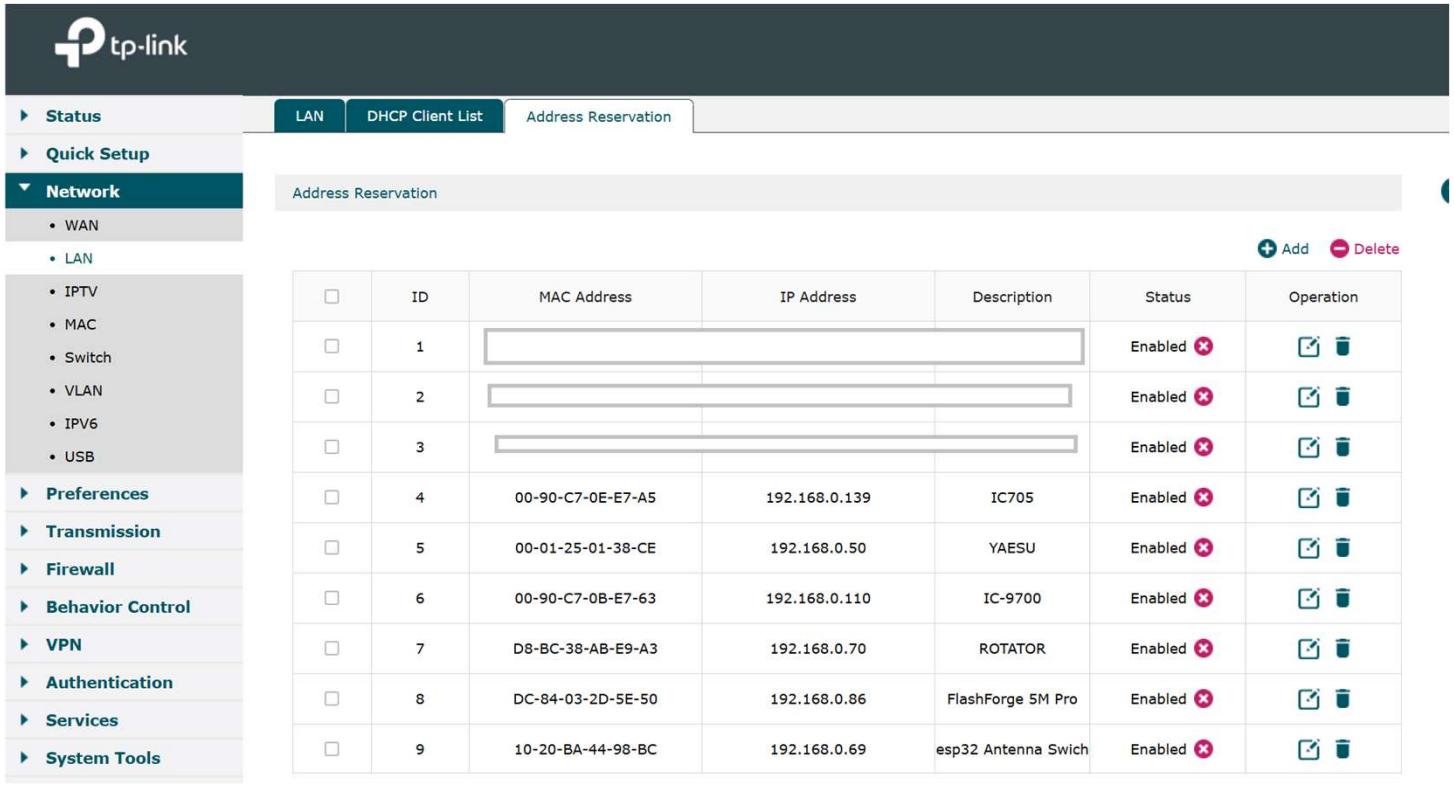
IP Addresses Reservation



- Look for a feature called Address Reservation, usually under LAN settings. AI is your friend.

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Remote Internet Access Connection Options

- Option 1 – Port forwarding
  - Open the required ports used by the software and use DMZ/Port forwarding to direct them to your radios IP address.
  - No security – anyone can access those ports if they find them, and they will find them. But you radio has it's own security, and is unlikely to be a target of hackers, there is nothing to gain. But your PC etc.. Is another story!
  - Tricky if you have multiple devices (radios) using the same port numbers.
- Option 2 – VPN (my preference)
  - Configure your own VPN on your home firewall
  - More secure
  - Provides access to all your home devices 'as if you were at home'

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Remote Internet Access – IP Addressing

- It is likely your home internet is not a fixed IP address
  - Your IP will change – so how can you configure the remote connection?
- If your provider offers fixed IP then use that option, much easier.
- Otherwise use a Dynamic DNS service DDNS (like NO-IP)
  - Gives your address a “Name” that remains the same even if address changes
  - Check your router settings, look for ‘Dynamic DNS’
  - See what providers it support, e.g. NO-IP
  - Compare them, usually ‘free’ versions to use, and create an account
    - E.g. yourname.ddns.net
  - Configure your router with the account settings.
  - Your router will ‘inform’ the service if your ip changes
  - You use the dns name yourname.ddns.net to connect instead of an IP address.

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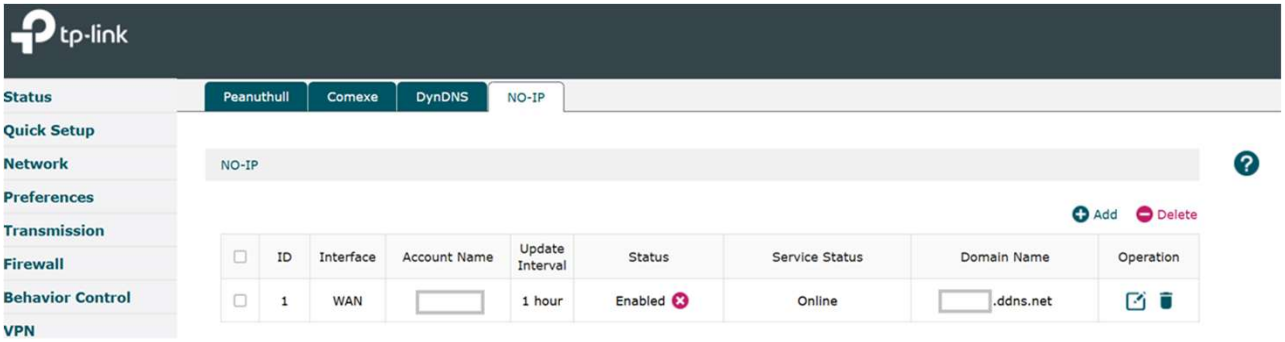
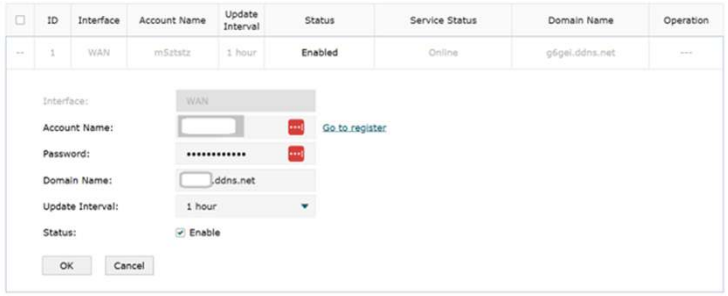
Home VPN

- Example DDNS config on my tp-link router





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Home VPN

- This will depend largely on your make/model of Router.
- The principles will be the same. AI will help you.
- Look for the VPN option in your router config
- I use L2TP as it's relatively easy to config and relatively secure, if used with Ipsec Encryption.
- You will need to create a L2TP Server with a pass key (pre shared key).
- Then create a login account/user with some credentials.
- Then install a VPN Client on your remote devices (Phone/iPad etc.)

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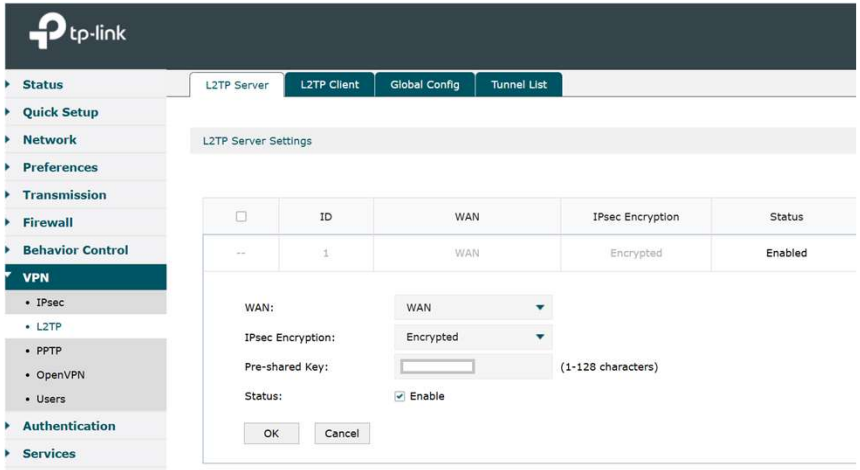
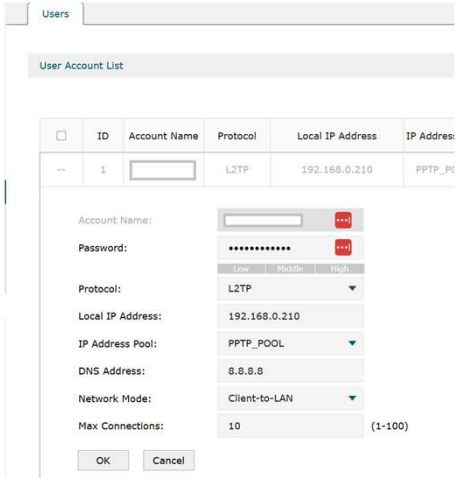
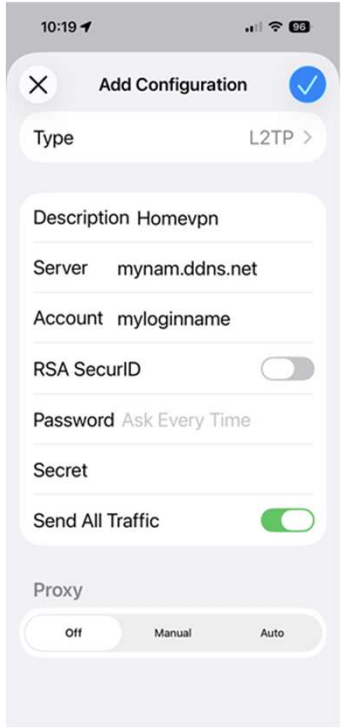
Home VPN



1) Configure the VPN Server side, with pre-shared key



2) Define a user account with name and password



3) Configure the client

4) Connect to the VPN client, entering password, before using the radio etc...
You can now access any devices in your home using their internal IP addresses etc..

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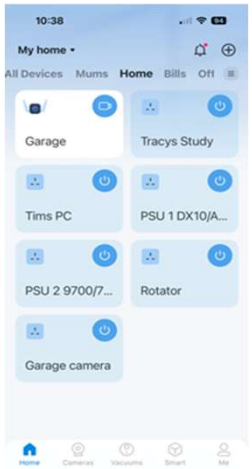
Power Control

- We want to turn on/off devices remotely for obvious reasons.
- There are many low-cost options for this.
- I use a Tapo power strip which allows me to control 4 devices in the shack, there are many other options.



From my phone I can turn on/off

- PC
- FT-DX10 PSU & remote Antenna control
- IC9700/7300 PSU
- Rotator

You can also install a camera in the shack and view your station etc. using the same App.

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Antenna Isolation

It is a good idea to disconnect antennas when not in use to help protect from ESD etc.
Nothing is going to save you from a lightning hit, but increasing the separation between the radio and antenna can't be a bad thing.

I built this antenna isolator that isolates both the coax inner and outer when powered off, it provides an air gap of between 2-3mm between the antenna coax and anything in the shack. Not perfect but everything helps right?

Features :

- Antenna coax isolated on power off (both inner and outer)
- Antenna coax inner/outer shorted on power off
- Can provide BiasT power to power up remote ATU
- Shack side of coax connected to 100W Dummy load when powered off.

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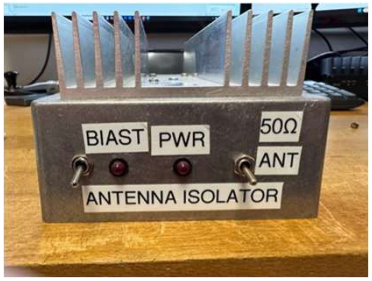
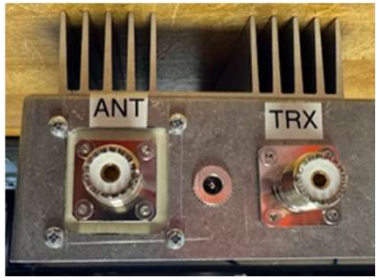
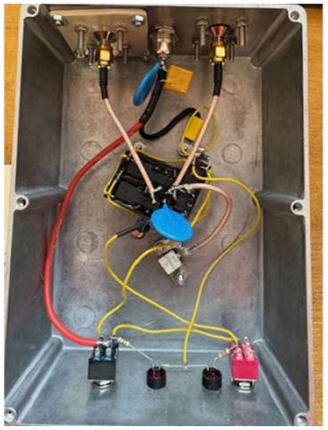
Antenna Isolation



Heatsink for the 100W dummy load resistor (a bit big)



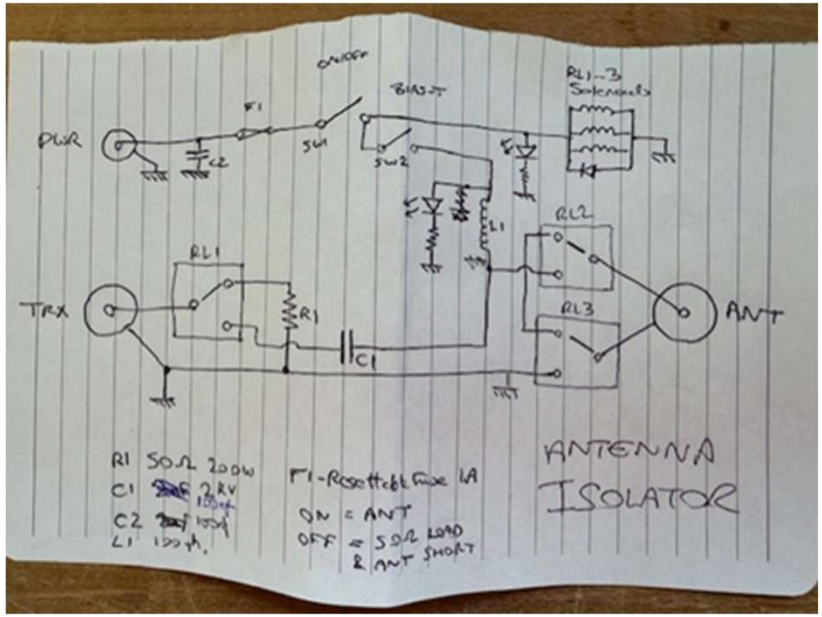
The isolation of inner **and** outer on the antenna side.



3 Relays – fed with coax from the connectors, all RF leads kept short. Negligible insertion loss/SWR impact on HF/6M.

A flange mount 50 Ohm 100W resistor switched in for the dummy load.

Simple inductor/capacitor BiasT circuit, switched.



'Back of fag packet' design. Hopefully clear enough. R1 is the 50 Ohm dummy load, C1 isolates the BiasT voltage, L1 is the BiasT inductor. Relays shown in powered off state.

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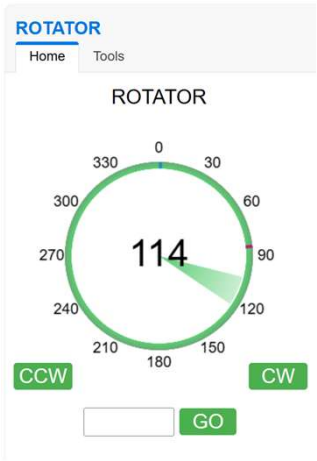
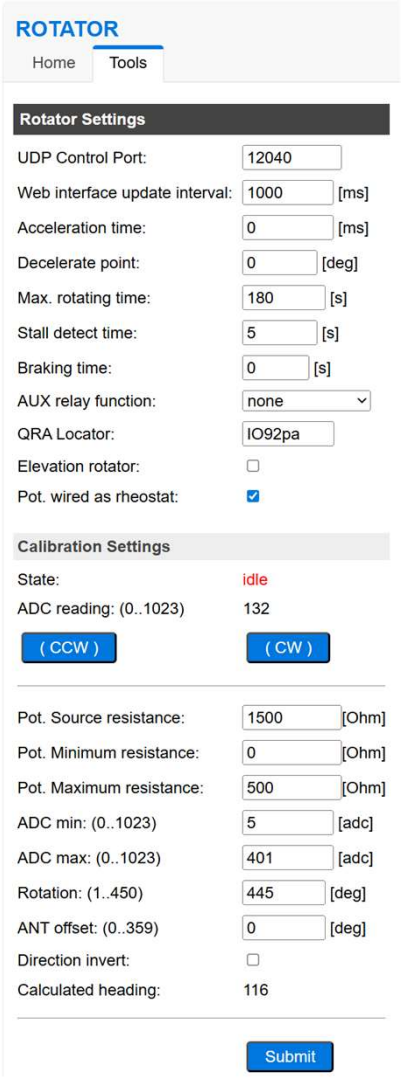
Rotator Control

I have a Yaesu G450DC rotator which I wanted to control remotely as I usually have 6m Yagi attached in the ‘open season’.

I found this simple low cost Arduino based controller by AF6SA that allows easy interfacing and provides a web-page to control the rotator. It also allows control form PSTRotator etc. and accepts Yaesu rotator commands over IP. It supports a huge range of Rotators and will even work with your home made stuff…





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Antenna Control etc..

I have a selection of radios and antennas I use in different scenarios:

- IC-7300 – My normal in shack use radio, has no network connectivity – use on HF/6m
- IC-9700 – Used for general 2m/70cm and sometimes QO-100 operating. Networked.
- FT-DX10 – I use for remote access on HF/6m. Networked via SCU-LAN10 interface.
- IC-705 - Sometimes used in shack, connectable by Wifi
- HF Vertical at bottom of garden with Remote ATU powered by BiasT.
- Mast with Rotator and Yagi which is interchanged between 6m/2m/70cm etc..
- Satellite Dish/up-down converter for QO100
- White Stick vertical for 2/70.
- Dummy load.

- I wanted to select which radio/antenna to use remotely so I could (for example) switch between HF and 6m, or toggle between white stick and QO100 on the 9700 etc.
- I wanted to **control the power** to the ATU, QO100 box, a biasT for masthead amp and the IC705.

- I could not find an off-the shelf solution for this, so had to make my own ☺

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Antenna Control solution..

The solution was to make my own antenna controller, based on an ESP32 microcontroller and some multi-way coax switches. This took about 9 months to complete, including the software. It's features are:

- Switch 1 of 6 antennas to 1 of 6 radios/devices
- Configurable device names so can change how I use it.
- Secondary by-pass to allow the 9700 to be left on the white stick when not wanted elsewhere.
- 4 switchable relay outputs for powering 12v devices
- Touch screen for use in shack
- Web site for remote control

It works well. The coax relays are good to at least 70cm 100W, in theory they are good to 18Ghz but at lower powers. Negligible insertion loss or affect on SWR, and 60db Isolation (120 of course because 2 are used).

Not for the feint hearted, especially the coding, but can share more on this later if anyone interested.

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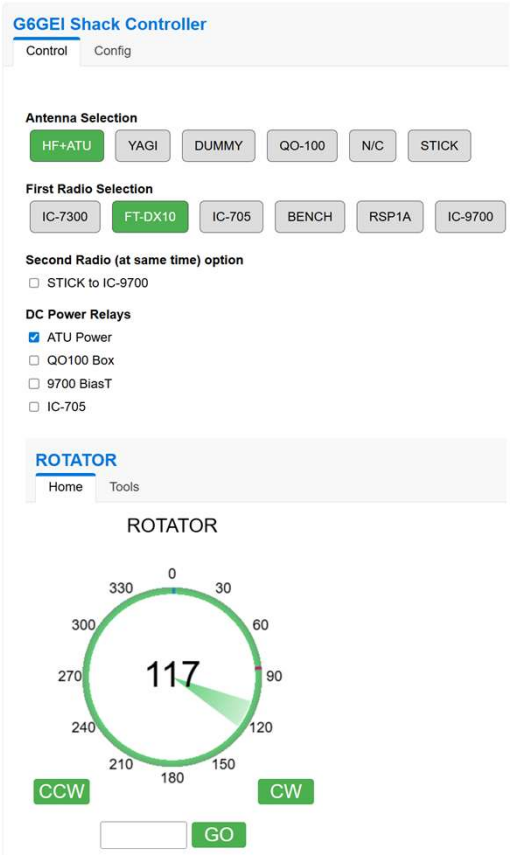
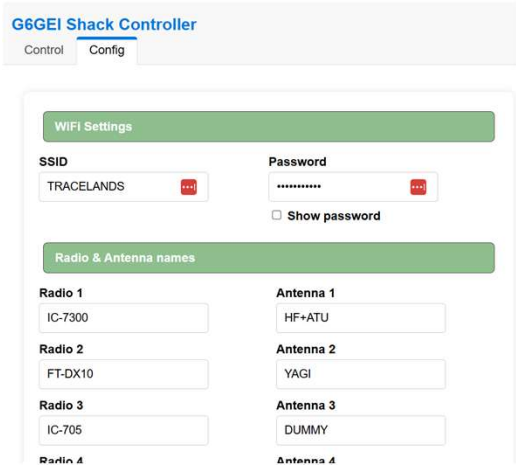
Antenna Control solution..

Touch panel in the shack. Just touch to select each radio/antenna. Sliders for the power to devices.



The website interface.
Note I included the rotator control on the same page so only need to load one page to control both.



Devices can be renamed.

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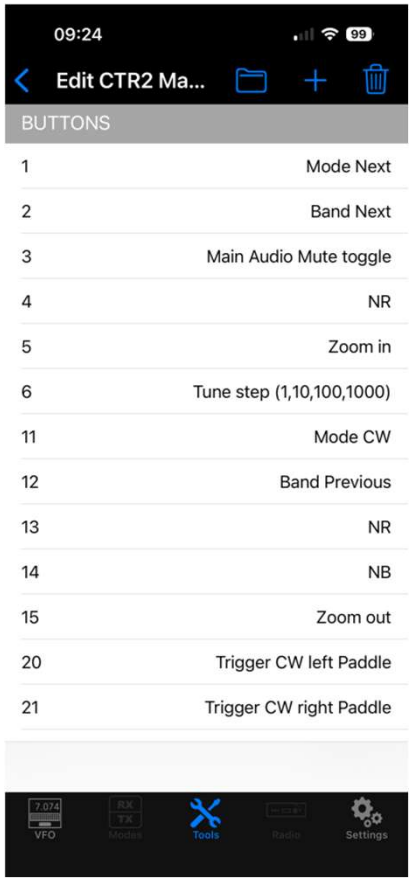
Tuning and CW Paddle

MIDI Controller
Connects via USB or BlueTooth.
Tuning dial
6 Programmable buttons
Jack input for Paddle
$70 assembled, used to be available as a kit.

Can connect to phone/tablet directly or via USB Hub or via BlueTooth.

Do not expect a straight CW Key to work with this software!

Do not expect CW to work through Yaesu SCU-Lan10!



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The Software

Saving the best till last

It is hard to write this without it reading like a promotion for the software, but it really is awesome!
https://ham-radio-apps.com/

Runs on macOS and iOS and supports Flex, Icom, Yaesu, Kenwood, Elecraft
You can look at the website, but just for starters:

- Full radio control of most radio features – including waterfall display
- Built in logbook with usual features and integrations to LOTW,QRZ,eQSL,CloudLog etc.
- Hardware support for tuning controls & buttons and keys/paddles
- DX Cluster support
- POTA spotting
- Built in FT8 / FT4 / PSK-Reporter
- CW Keyer/Decoder
- WeFax
- SSTV

Note: doesn't support straight cw keys
Only paddles.

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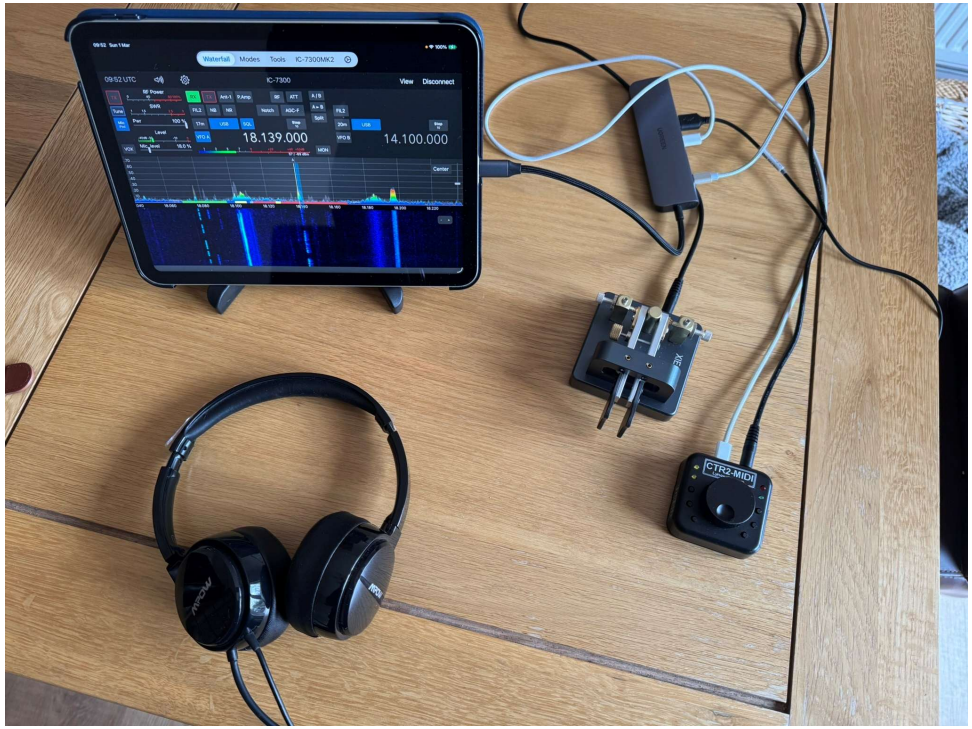
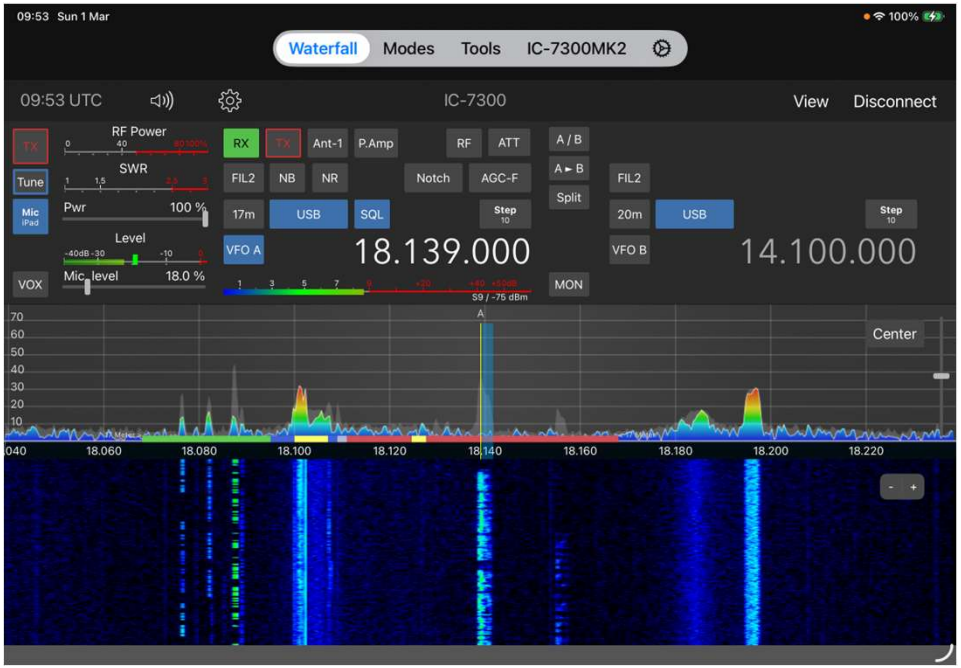
Remote station with iPad etc..





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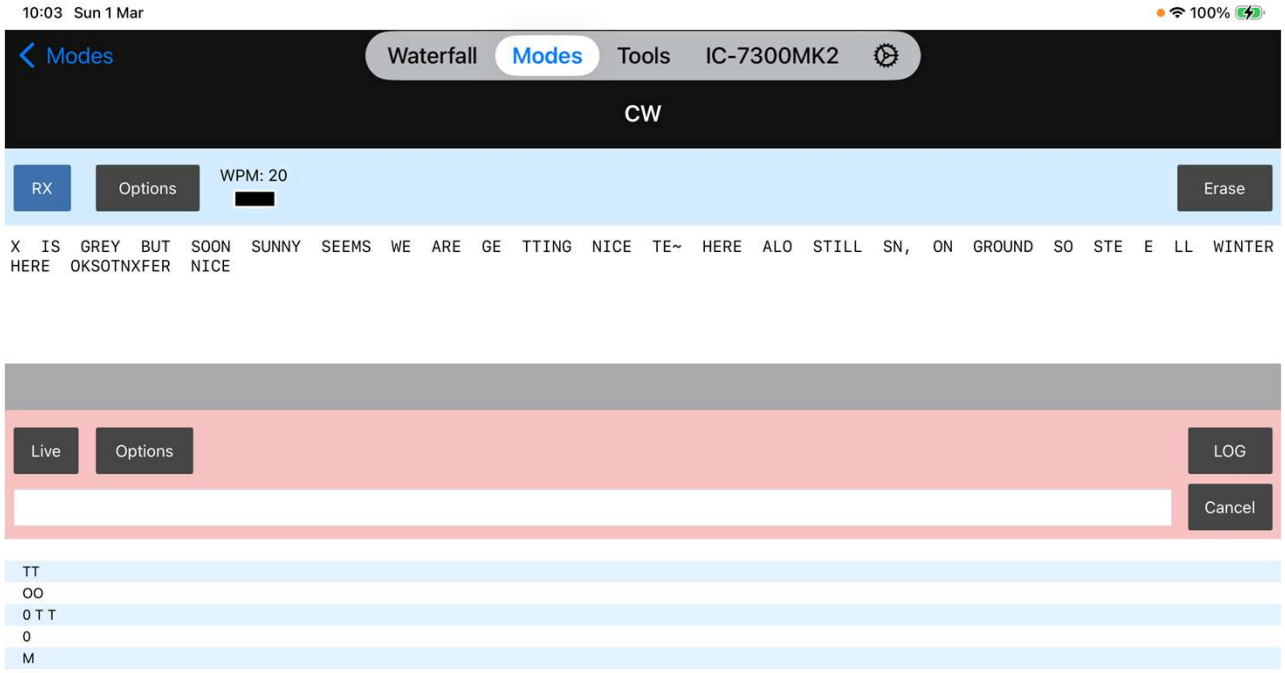
Operating CW



CW Mode has built in decoder which is pretty good when tuned to the correct audio freq. A tuning UI helper would be a nice addition.

Also built in keyer for non-CW operators or those who prefer to use memories for automation.

Paddle interface if using Midi Controller etc.

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SSTV

Send and Receive SSTV

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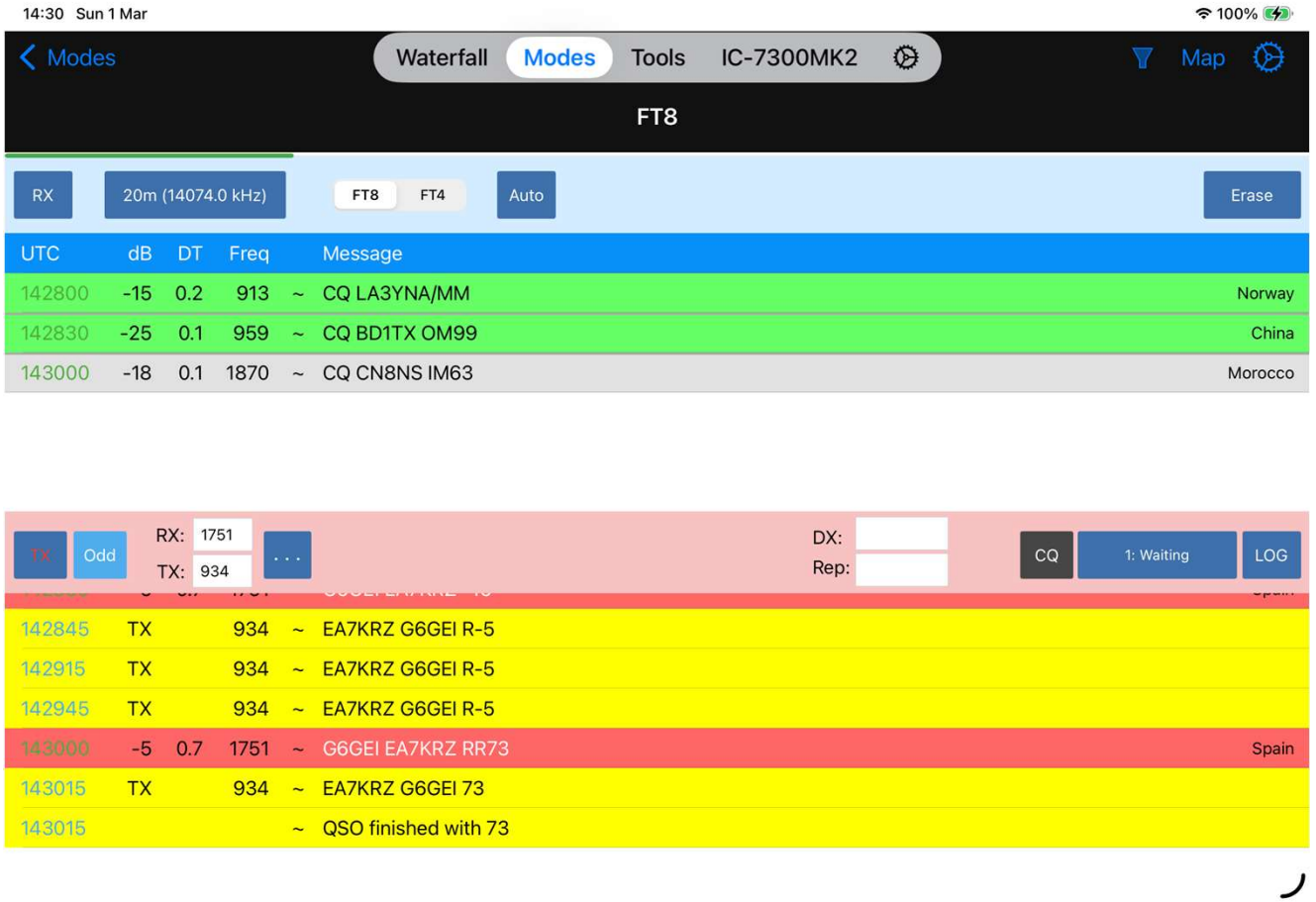
FT4 / FT8

Built in FT4 & FT8

Automatically logs (option).

Remembers worked before etc.

Can report to PSK Reporter



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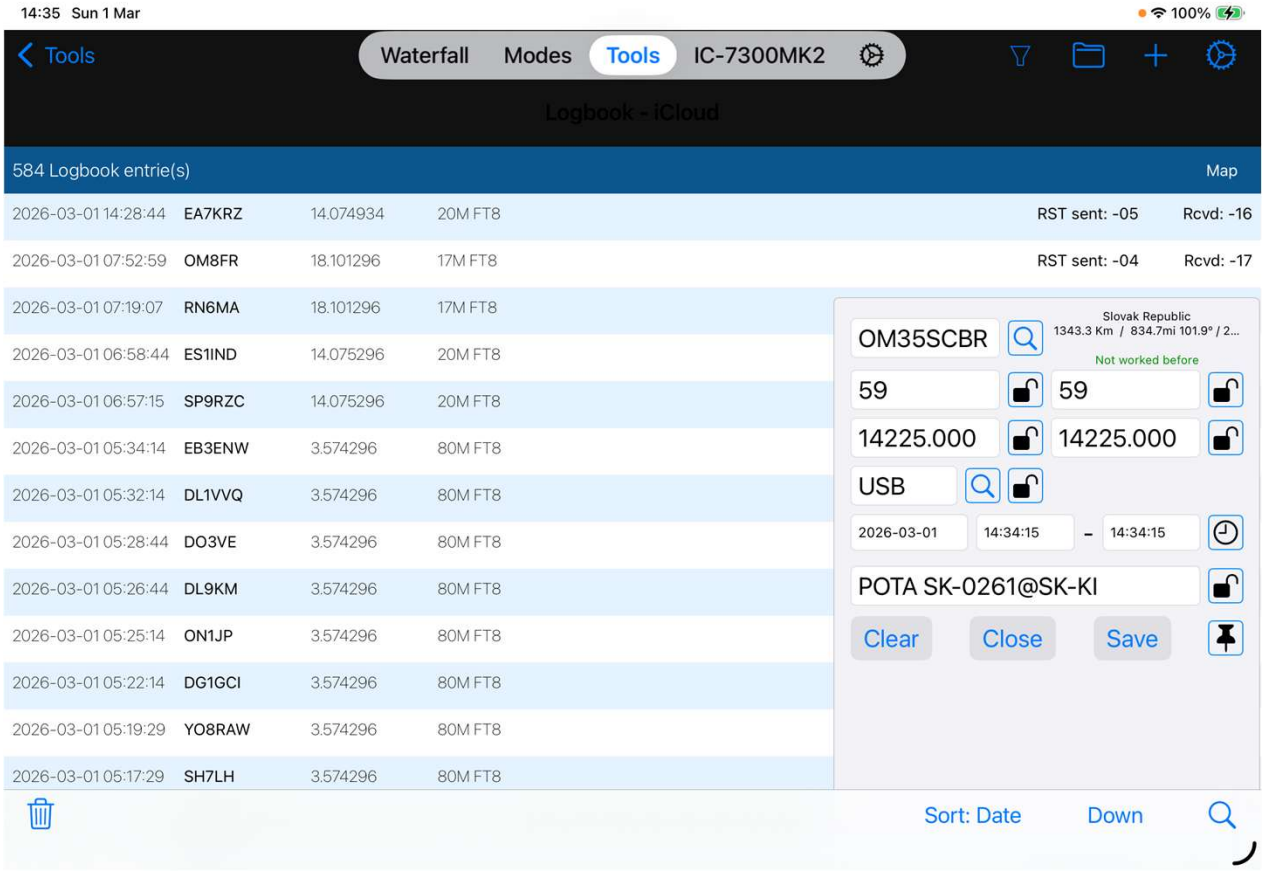
Logging

- Built in logging.
- Simple to use.
- Saves to local device or the cloud.
- Can export ADIF
- Contest mode
- Custom Fields
- Lookup v QRZ.COM or HamQTH.
- UDP Broadcast to other logging s/w (I use Log4OM)
- WSJT-X broadcast decode and log.
- Logs POTA details



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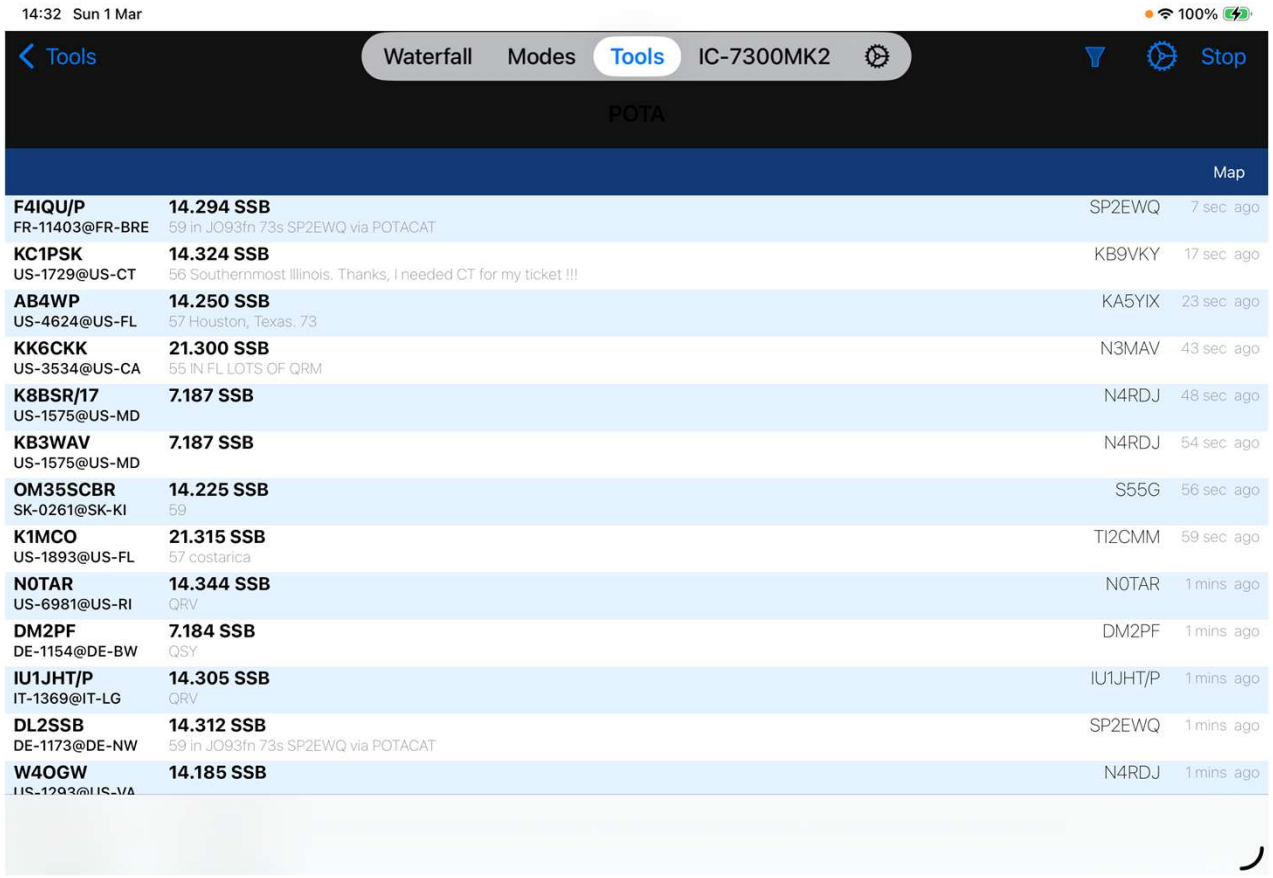
POTA

- Reads POTA spots from POTA.app
- Filter by Band/Mode
- Tap a spot to tune VFO to freq and prep a log entry.
- POTA Spots appear labelled on the waterfall.
- I always use this when in a park – shame it can't self spot....



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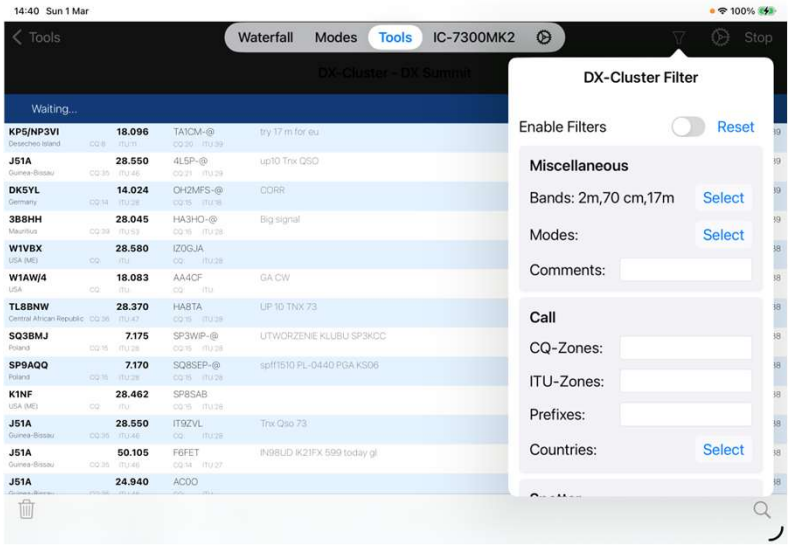
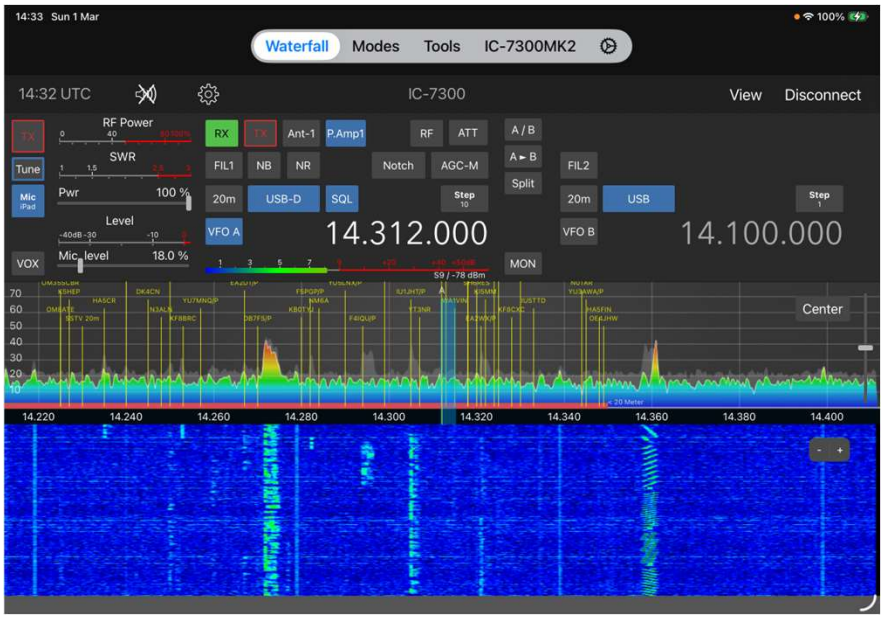
DX CLUSTER

- Built in DX-Cluster view.
- Filter by band / mode / zone etc...
- Tap call to tune VFO
- List of pre-defined servers or add your own.





- Cluster spots appear on the waterfall.

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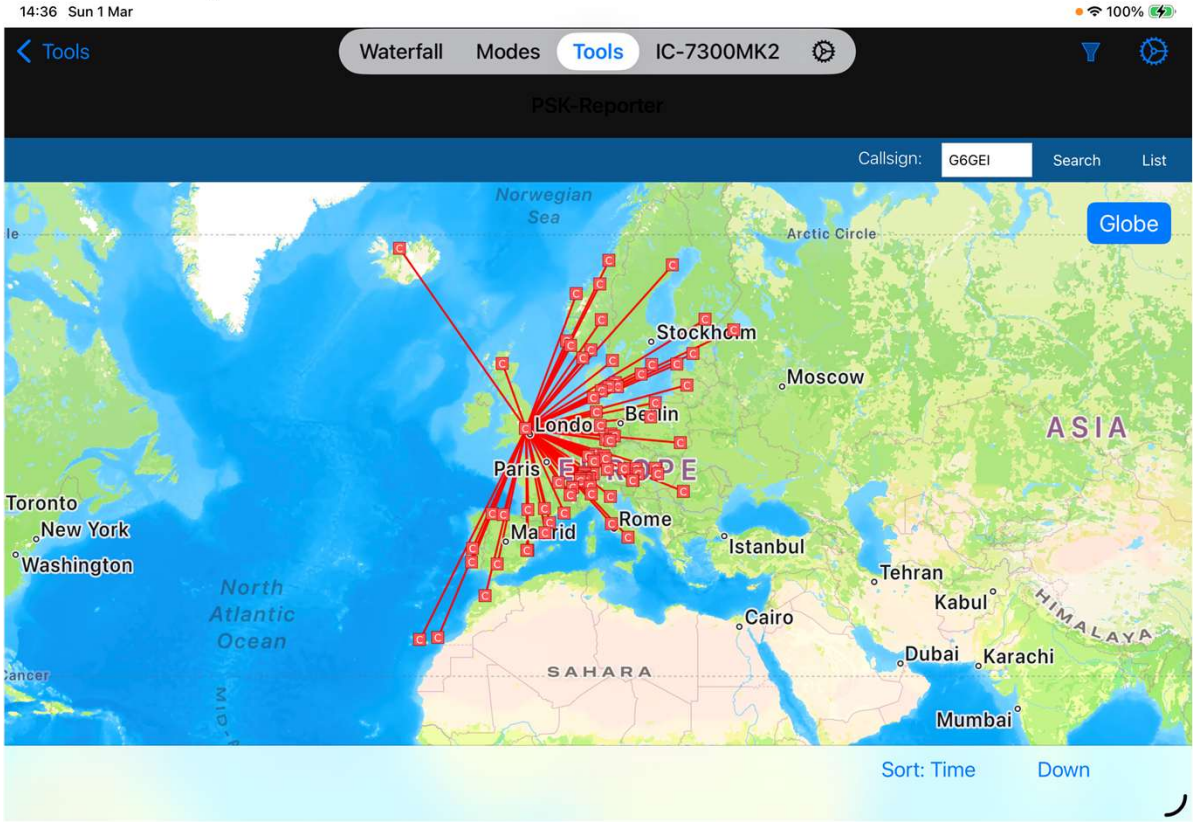
PSK-Reporter

- See where you or others have been heard
- Filter by band/mode
- Map or List view.
- Gives details of each spot in list view.



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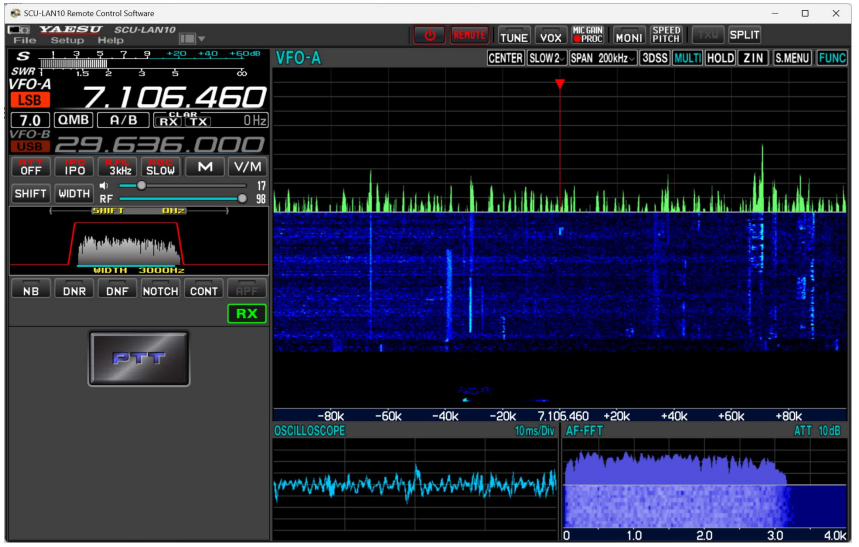
Alternative Ideas

I have also played with the Yaesu **SCU-LAN10** remote software, which is nice to use and works well for voice but doesn't seem to allow remote operation of data modes as the audio is not routed/accessible outside the app.



I would consider just using the shack PC remotely (**RDP** etc.) which will allow all normal desktop apps to be used. Not sure how the CW option/keyer would work.

The PC can be set to auto start when mains is applied, but am wary of pulling power on the PC if unable to do a clean shut-down first, and don't like leaving the PC on.

I have also used Win4Icom. Allows for remote control over IP but requires a PC at the shack. It can send/rx audio though which allows remote data mode apps like WSJTX etc.

Also look at VBAN, a network version of VBAUDIO (Virtual audio adapters) for connecting remote software to audio in/out.

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References

Rotator controller – http://www.af6sa.com

The relays in the antenna switch are Teledyne RF Coax Relay Switch SP6T 0-18GHz 60dB Model CCR-38S26C-T and available on eBay, I paid about £60 each.

HAM Radio Apps by DL8MRE https://ham-radio-apps.com/

Lynovation CTR2 Midi controller (tuning dial) https://ctr2.lynovation.com/ctr2-midi/

Win4Icom suite https://icom.va2fsq.com/remote-control/

VBAN Audio Network over IP https://vb-audio.com/Voicemeeter/vban.htm

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In Action

Let’s have some hands-on play time !